Acousto-Optical System for Active Acoustic Cancellation of Sound Waves for Active Sonar Defeat

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Introduction

As active sonar systems, including those disguised as natural whale sounds, have increased the visibility of both surface and sub-surface ships, a method for rendering active sonar obsolete would prove useful.

Abstract

Sound waves may be used to eliminate other sound waves provided that the frequency of the waves is matched and the direction of travel is opposed. Active sonar cancellation is possible with the use of LASER interferometers to measure the characteristics of sound waves approaching the hull of a ship in order to inform the generation of outgoing sound waves.

Toward this end, the hull of a ship such as a submarine or the sub-surface portion of the hull of a surface ship may be painted with an acoustically reactive paint which can generate a wide range of ultrasonic noise according to instructions from a computer. This paint would be capable of emitting different patterns of sound from different sections of hull with the aim always being to emit noise which perfectly matches the ambient noise and to do so before the ambient sound waves arrive at the hull.

LASERs are already employed on submarines both for the purposes of flash-heating seawater in order to achieve a transient lensing effect which enhances passive sonar as well as for collision avoidance. By adding just a few more LASER emitters to a submarine, with these emitters being geared toward an interferometry application, it should be possible to accurately measure incoming sound waves well-prior to their arrival at the hull and use that data to inform acoustic emissions from the specialized electro-acoustic paint.

It would be important for the software guiding such a system to differentiate between outgoing acoustic energy and inbound acoustic energy; something which should be relatively simple given that this boils down to the Doppler Effect.

Subtle fluctuations in the reflectivity of the water at various ranges (which naturally correspond to time-of-fight) would inform the system as to the precise characteristic of active sonar-associated noises prior to the arrival of the sound waves and, with a sufficiently speedy computerized response, perfectly calibrated outbound acoustic emissions would negate the active sonar prior to its arrival.

Conclusion

If successfully implemented, this concept will fundamentally and irrevocably alter naval warfare by negating the usefulness of active sonar in any case wherein such an active cancellation system is employed.